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MUSHROOMS OR TOADSTOOLS:

A Natural Food Product.

By L. F. HENDERSON.

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BULLETINS.

The regular bulletins of the Station are sent free to all who request them. Some bulletins issued lately are:

21. The Codlin Moth.
22. Onion Growing.
23. Meteorological Records and Prediction of Frosts.
24. Cattle Feeding and Crop Tests.
25. The Composition of Arsenical Insecticides.
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MUSHROOMS OR TOADSTOOLS:

A NATURAL FOOD PRODUCT.

By L. F. Henderson.

I.

Mushrooms or Toadstools in their various forms are natural food products laid at our very doors by a bountiful nature, and yet they are generally overlooked, or if observed are in the main avoided with a shudder. It will be the object of this bulletin to acquaint the people of our State with the common species, to show that the majority of them are not only *not* injurious but of great culinary value, to give a brief sketch of their growth, their kinds, the methods to be used in their collecting and in preparing them for the cook, and lastly a few recipes showing the best ways to prepare them for the table.

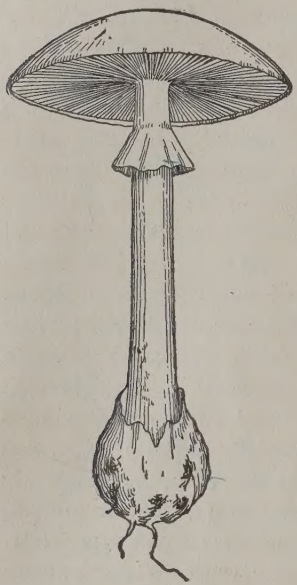
The ignorance which prevails in this country in respect to mushrooms is much greater than in most of the states of Europe, and even in some of the parts of Asia, notablv Japan and China. In these various countries the population is so much denser the number of the poor is so much larger, and the cultivable land is so restricted in comparison with the numbers concerned, that more attention to these natural products of the soil has been given, or even forced upon them, with the result that mushrooms are collected in immense quantities and varieties, and are dried for home consumption or offered in the markets as regularly as are the common vegetables. In many provinces in Europe

persons are appointed, whose duty it is to inspect the mushrooms collected and brought into market, to see that no poisonous kinds are introduced by mistake, and to give general information concerning the kinds, both poisonous and edible. In this way dozens of not only harmless but nutritious kinds are exposed for sale, the people generally become acquainted with them, fine foods or at least agreeable condiments are added to the common bills of fare at small prices, while many poor persons partly or wholly support themselves in gathering them for market. So highly are various species of mushrooms appreciated by the Japanese and Chinese of the Pacific coast, and so little are our native kinds understood, that tons upon tons are brought into San Francisco annually in a fresh or in a dry state for consumption by these people alone. Specimens of the celebrated Japanese varieties, the Shiitake, a species of Lepiota, and the Matsudake were recently sent to our institution by a Japanese gentleman, arriving here in a nearly fresh condition, and we were assured by the donor that they were a regular article of food upon his table. In nearly any of the forests of the Northwest tons upon tons of valuable and nutritious mushrooms go to waste annually, either totally unobserved or avoided with distrust by the observant under the impression that they are "toadstools" and consequently poisonous. Many a prospector, surveyor or hunter in our vast and unpopulated districts has gone hungry,—nay, it may be, has died from hunger,—with food in great quantities and of varying degrees of nutritiousness and excellence going to waste about him! The too common expression, that "toadstools are dangerous things, that people don't know anything about them, and that the safest way is to let them alone," is too foolish for utterance, and would not need to be mentioned in this connection did not this opinion receive the sanction of otherwise sensible and even educated persons. With just as much reason can you say that beans cannot be told from peas, cabbages from turnips. A child of ten years of age, with common powers of observation, to say nothing of adults, can be told in a few hours how to distinguish at least a dozen species

of edible mushrooms, and, when poisonous species exist whose look closely resembles that of harmless species and whose confusion might lead to serious consequences, to reject *all* suspicious kinds. It is not necessary for mushroom lovers to know scientifically *all* the many kinds in their neighborhood; it is sufficient if they know a dozen or two, for from these they can select kinds that are accessible and available almost every month in the season from early spring to late fall. Luckily too, the poisonous kinds are not nearly so common on our coast as in the Eastern and Southern states, and therefore less danger is incurred in mistaking different species, especially the poisonous for the harmless. Not a single really poisonous species has been found by the writer in the state of Idaho up to this date. Yet for this reason we should not be too sanguine that poisonous species do *not* exist here; it should rather put us on our guard to avoid any accidents due to fancied security. This should be carefully kept in mind, that mushrooms, or toadstools if you prefer the term, are constantly succeeding one another throughout the spring, summer and fall. The same locality therefore that may have furnished only harmless forms at one time of the year, may a month later produce poisonous or at least disagreeable and harmful kinds. So the only safe way of avoiding danger is *to know your plants collected*, if they are to be cooked, or to find out what they are from some one competent to inform you if you do not know them and wish to try some or all on the table.

And right here it might be pertinent to express the wonder that more persons are not killed annually than are, on account of the careless way mushrooms are sometimes gathered, the good with the bad, or on account of the carelessness with which different species, somewhat resembling one another, are collected and no care given their identification. I know of one gentleman who laughingly stated that when he drove out into the country after mushrooms, he collected generally all that were tender, *and ate them all*, so convinced was he that no poisonous kinds exist in the region from Spokane to Lewiston. Mr. F. V. Coville, Botan-

ist of the Department of Agriculture, mentions in his "Observations on recent cases of Mushroom Poisoning in the District of Columbia" a case, where a lady walking the streets of Washington one day "met a family, consisting of a man, woman, and two children, who had just completed the gathering of a basketful of the fly amanity and the death cup, which they were taking home to eat." These are two of the most poisonous kinds that are to be found, and these people had evidently mistaken them for harmless species. Yearly our papers in different parts of the country are called upon to record sad and terrible deaths through mushroom-poisoning, due in great measure to absolute carelessness in separating the harmless from the harmful kinds, or to careless experimentation with species known to be harmful.



Death cup, *Amanita phalloides*. Poisonous. Two-thirds natural size. F. V. Coville, Circular No. 13, U. S. Department of Agriculture, Division of Botany, "Observations on Recent Cases of Mushroom Poisoning in the District of Columbia."

What is a Mushroom and What a Toadstool?

Right here it might be useful to answer that oft-repeated question "How am I to know a Mushroom from a Toadstool?" In answer let it be distinctly understood that there is *no* difference between a toadstool and a mushroom; all mushrooms are toad-

PLATE 1. The Common Mushroom, *Agaricus campester*, springing up spontaneously in a hot-house rose-bed. One-third life size. The mycelium, or "spawn", was unconsciously introduced with manure.

Fig. 1

Fig. 2

stools and all toadstools mushrooms, according to which name you prefer. Many people limit the name mushroom to the common Field Mushroom, *Agaricus campester*, and consider all others, not possessing the "pink gills" of this species, toadstools. This is too limited and even misleading a use of the term, for many of the mushrooms used in different countries, and sold in the market as such, do not belong to the same genus or even family to which the Field Mushroom belongs. A few of the tests, supposed to distinguish the poisonous from the non-poisonous kinds, and therefore a mushroom from a toadstool supposably, will be given here, while it will be distinctly stated that not one of these supposed tests is of any value, relied upon alone. Such are: 1.—Eat only mushrooms grown in open ground, never one in the woods. 2.—Eat no mushroom whose gills are not pink. 3.—Eat no mushroom that will discolor a silver spoon. 4.—Eat no mushroom which is white all through or that will exude milk when cut. If we should obey the first injunction, we would be cut off from nearly all the Boleti, the Morells, the Cortinarii, the Pleuroti, and a host of others. If the second we would be limited to the Field mushroom and a very few others, and lose all those delicious kinds whose gills are red, yellow, white, or with even shades of blue and green. If the third we would lose the gastronomic pleasures of many harmless kinds, some of which do, some do not, change or darken silver. If the fourth, we would be cut off from the yellow or red Boleti, the white Hygrophori, or the red or yellow Cortinarii, as well as from a number of the delicious milk-giving Lactarii. In fact the usually safe rule "Avoid all mushrooms or toadstools with a *cup* at the base of the

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PLATE 2. The Common Mushroom, *Agaricus campester*, often known as "Pink-Gills." Slightly reduced. Two of the specimens are expanded and past their prime for food. One specimen is split through the middle, in order to show the "veil" still attached to "cap" and "stem". The absence of any volva, or "cup", at the base of the stem is noticeable, thus affording a good character by which to separate this genus from the Poisonous Amanita, often mistaken for one another.

stem," though an excellent rule in the main, is not to be relied on implicitly, as the beautiful *Amanita Cæsarea*, whose base has a very perfect cup, has been the theme of epicures from the time of the Greeks and Romans. Yet as this *cup* is the badge of the genus Amanita, with a few closely related, and as this genus of plants includes most of the poisonous ones in the United States, it is best to avoid them all. I shall probably be pardoned quoting here a more exact rule as given in Charles McIlvaine's excellent work on "One Thousand American Fungi, Poisonous and Edible," though somewhat lengthy, for by its strict observance nearly all the poisonous kinds can be avoided. "Any toadstool with white or lemon-yellow gills, casting white spores when laid, gills down, upon a sheet of paper, having remnants of a fugitive skin in the shape of scabs or warts upon the upper surface of its cap, with a veil or ring, or remnants or stains of one, having at the base of its stem—in the ground—a loose skin like sheath surrounding it, or remnants of one, should never be eaten until the collector is thoroughly conversant with the technicalities of every such species, or has been taught by one whose authority is well known, that it is a harmless species." Luckily, as before mentioned, Amanitas exist, if they exist at all, but rarely on our Northwest coast, none having been seen by the writer in Idaho. Even should they not exist here, care must be taken in eating mushrooms without sufficient trial *by each collector*, as nowhere is the old adage truer than with these plants, "What is one man's meat is another man's poison." Even should none of our species prove absolutely poisonous, many of them are intensely disagreeable as well as inedible, and their eating, even if they were not repellant to the appetite, would be followed by indigestion and bowel complaint, if by nothing worse. People are to be met with quite often upon whom strawberries and eggs act as poisons, and even butter is sickening and causes nausea to some. An acquaintance of the writer is rendered sick whenever he eats liberally of the common mushroom, Agaricus campester. Therefore the best rules to be followed, for any one pretty well acquainted with the study

of mushrooms but unacquainted with their *taste*, and especially for the novice in either capacity, are these:—If you know a mushroom, and one which by common report is harmless and edible, eat of it sparingly, till you find out by *personal experience* that it does not disagree with you. If you wish to test species entirely unknown to you, first cut out a small piece of the solid meat, using special precautions to see that it is not invaded by the larvæ of insects, and chew it up, not swallowing the fragment or its juice. If it has a very bitter taste, discard it at once. If it has a peppery or acrid taste, be equally careful, or swallow a little of the juice to mark its effect. This is well, as many of the best species when cooked lose the acrid or peppery taste of the raw plant. On the other hand, most of the harmful species, excepting some of the Amanitas, have at first a disagreeable, acrid or peppery taste; so one should exercise the utmost care where any of these tastes are present. When, on the other hand, the plant has a good smell and a taste like raw meal, or perfumed like fruits of various kinds, or not objectionable in any way, it may be reasoned that it is probably not harmful, and a little of the juice may be swallowed. If it is found after the lapse of an hour or two that it has not harmed you, try a larger piece. Mr. McIlvaine, the gentleman above quoted and who has experimented with and eaten more toadstools than probably any other person in the United States, says, "But many species, delicious when cooked, are not inviting raw. Cook a small piece, do not season it. Taste again; if agreeable eat it (unless it is an Amanita). After several hours, no unpleasant effect arising, cook a larger piece, and increase the quantity till fully satisfied as to its qualities. Never vary this system, no matter how much tempted. No possible danger can arise from adhering firmly to it." Some of the commonest ways of cooking mushrooms will be given at the end of this bulletin.

Where Do Mushrooms Grow?

The answer is brief—wherever other plants grow. Some gen-

era delight in the open fields, some in moist dense woods, some on old stumps and logs, some on railroad embankments, while some plebeian but delicious species grow on manure piles and rotten straw. Of the species specially discussed in this paper, the field Agaric or mushroom loves the grassy pasture, especially when browsed by cattle and enriched by their droppings; the two species of Coprinus cling, at least in Idaho, almost exclusively to railroad cuts and embankments, or to places where engines stand considerably and cinders are thrown out; the Ivory Hygrophorus and other species of this genus like pine and fir woods; the Hypholomas are found about rotten stumps and logs; the Boleti like thick fir forests, pine woods, or even open hills near woods; the Hedge-hog mushrooms surprise us as they almost light up the dark forests when standing erect upon or hanging down from fallen logs; the Puff-balls love open ground and are commonly associated with the field Agaric; the Morels seek retirement in woods or in copses along our hills. The mushroom is a rapid grower and both needs and contains much water. We may therefore conclude by saying that dry, rocky, or sandy places are about the only ones which do not produce mushrooms, while they flourish best in cool, moist woods and along creeks and rivers.

Besides their appeal to the palate, these interesting plants have much attraction for the one who collects them merely for study, on account of their strange and beautiful forms. Though many dress themselves in the veriest quaker drabs and grays, they all repay study with the microscope; while many of them are as beautiful in their colors and as variable and exquisite in their forms as the finest flowers. Every shade of color is represented in fungus or its spores; every shape of umbrella, cap, vase, globe, bush, tree, or map is faithfully portrayed in miniature; every smell

PLATE 3. The Shaggy-Mane Mushroom, *Coprinus comatus*, at the proper stage for food. Slightly reduced. Later the stem elongates, the loose "ring" drops to the ground, and the cap "deliquesces", that is melts into a fluid black as ink from the black spores. Of fine flavor, but stronger than the last.

Fig. 3

Fig. 4

from the exquisite apricot of Cantharellus to the disgusting nightmare of the Stinkhorn; every taste from that of ripe fruit and fresh meat to rotten wood, quinine, and things even more disagreeable or even disgusting, finds a representation in these fungi, leaving out of consideration the various things they mimic when cooked, such as meats, oysters, clams, steaks and numerous vegetables. Like the different flowers, they tell of grassy meadows, of thick shady woods, of mossy dells where the pheasant and the grouse speed from you on whirring wing, of old logs from under which the rabbit springs or on which the pine-squirrel sits and eats his meal from cones of fir and pine, of trickling rill or rushing river. It is strange that from the sins of a few of them such mingled feelings of horror and disgust arise in the average mind when you speak of "toadstools!" And yet it is none the less true that when any one has systematically hunted these much depreciated fungi for any length of time, whether as a student or as a "mycophagist" or mushroom eater, he has become much attached to them and their pursuit.

How and What to Collect,

We will first suppose that one is going out to collect mushrooms for the table. First of all notice whether any of the specimens you desire to collect have distinct "rings" or collars on the stem. If they have, dig them up carefully, and notice whether there is a distinct "cup" at the base of the stem, even with or underneath the surface of the earth. If they have this cup together with the ring, discard all such, as you have collected Amanitas. It is not meant by this that *all* toadstools not having these marks are wholesome, for some species not Amanitas are known to be poisonous. The number of poisonous species, outside of the Amanitas are, however, so few, in spite of the general impression

PLATE 4. The Ink-Cap Mushroom, *Coprinus atramentarius*. One is cut open to show the separation of gills from stem Slightly reduced.

to the contrary, that having eliminated this baneful but beautiful genus from our collecting, the greater part of the danger is eliminated at the same time. Having assured yourself that the plant is not an Amanita, see that it is free from larvae and that it is young and not past its prime. These two cautions are very important, as many mushrooms, sweet and nutritious when fresh, are bitter and nauseous when infested with larvae or when beginning to decay. It is even claimed by many that the deadly helvellic acid, found in the *Gyromytra esculenta*, is only developed when the plant is too old or inclining towards decay. Although this acid has been isolated from this species and several known cases of poisoning have been traced to it, yet this danger must be due to some unusual condition or incipient decay in the plant, for Mr. McIlvaine tells us that he and his friends have eaten of it again and again without experiencing the slightest discomfort from their daring. If the plant you are collecting is known to you as an edible species, these two cautions about larvae and too mature plants are the only ones to be noted. If however you are collecting toadstools about which you know nothing, you cannot proceed with too much caution. Test the plant by cutting off a portion of a fresh cap, and try it as before detailed for bitter, acrid, or peppery principles. If the piece has a pleasant taste and smell, a little of the juice can be swallowed, for even were the plant poisonous, a drop or two of the juice cannot injure you permanently. If by these tests it seems good for food, test the stem to see whether it is fleshy and brittle like the cap, or tough. Very few toadstools have the stem as fleshy as the cap, so that it is better to collect only the caps and thus save weight and dirt, unless the stem has been proved to be succulent and edible. If any of the stems are collected, the different plants should be wrapped in soft paper to prevent the dirt from getting into the gills or pores of the fungus. If you cannot refer these collections to someone who knows the main species in any district, and can pronounce upon their edibility with *certainty*, try them by the gradual cooking process previously detailed from

Mr. McIlvaine's book. Mushrooms should always be prepared for the table soon after collecting them If, on the other hand, you are collecting for study as well as for the table, more care must be pursued in their gathering. With a stout knife or trowel lift up the plants from the soil entire, or cut them out of the log or tree. Make on a slip of paper careful notes about the specimen as soon as collected, for it is difficult for the most expert student to distinguish species without such notes and when the plants have dried up. These notes should distinctly state whether the toadstool grows on soil or on wood, and what kind; whether the top of the cap is viscid, smooth, hairy, or water-soaked; whether the gills are free from or attached to the stem; whether the stem is fleshy and breaks easily or bends like rubber without breaking, or if it breaks, snaps with a decided snap; what are the colors of cap, gills and stem. It is especially necessary to make these notes in the field, for within the few hours elapsing between time of collecting and time of analyzing many of these valuable characters will have disappeared, and even before the specimen is dry most of them will have vanished. When these notes have been made, wrap each plant carefully in oiled paper if it is sticky or slimy, or in thin wrapping-paper if it is not, putting in the same paper the notes you previously made. If any one not possessed of books or other means of studying these plants, and yet desirous of learning whether the plant is edible or not, (and let it here be kept in mind that most of the toadstools *are* edible,) will exercise care in these notes and in wrapping good thrifty plants carefully in the paper, these specimens can if at all solid be sent some distance by mail or express to any student of the group. If this is to be done, a little moist but not wet moss should be packed about the plants carefully and the whole sent in a cigar-box or in one of heavy cardboard. This Station will be willing and pleased to make such identifications for any who may wish to become acquainted with some of the edible species of toadstools and who will make the proper notes and exercise due care in packing and sending the specimens.

After the plants have been brought home, and you have collected too many species to determine them all before they will have wilted, and so lost some of their important diagnostic characters, make copious notes upon a slip of paper, and let this slip accompany the plants while they are drying. It is unnecessary to say that it is much more satisfactory to analyze your plants while they are fresh; but if this for any reason cannot be done, the copious notes are essential. Besides the notes, a very helpful as well as beautiful object is a "spore-print" of the mushroom. To make this, have ready thick paper or cardboard on which a very light coating of mucilage has been placed and allowed to dry. Cut off the "cap" of the mushroom and turn it with the gills or pores *downwards* upon the gummed paper. Set over the specimen a bell-jar, or failing this a large dish, to completely cut off any currents of air. After a certain period, varying from an hour or two to a day or more, according to the specimen you are dealing with, innumerable quantities of the spores will drop from the gills or pore-surfaces upon the paper, the water in the fungus sufficiently softening the mucilage, and will leave a perfect print of the plant used, the gills or walls of the pores leaving tracings upon the paper unmarked by any of the spores.

This is most necessary; for in the large and important family of Agaricaceæ the colors of the spores are among the most useful means of determining genera. Moreover, these various colors—white, yellow, rosy, purple, brown, and black—are entirely independent of the color of the gills or spore-bearing surfaces; while spores which, viewed *singly* under the microscope, may seem of one color, often prove when collected on a spore-print to be of quite another color. While the different spore-prints are making, providing careful notes have been taken, the specimens to be preserved must be dried out quickly, so as to kill the larvæ before the fungi are riddled by their canals, as well as to preserve the

PLATE 5 The Ivory Hygrophorus, *Hygrophorus eburneus*. Slightly reduced. Very common in pine woods. A delicate and delicious mushroom. Known readily by its snowy whiteness and viscidity.

Fig. 5

Fig. 6

colors and prevent decay. Professor G. F. Atkinson of Cornell University uses for this purpose a large oven made of tin perforated here and there with holes, and containing many metal frames also perforated, so as to allow free circulation of air while the plants are drying. This tin oven is raised upon legs, so as to allow a gas jet to be placed under the bottom of the oven and thus furnish a regular heat. By the proper regulation of this heat, by the perforations in the compartment-frames, and by care in occasionally turning the specimens, they can be dried out perfectly in the course of a few hours or a few days, depending upon the size and water content of the different species. Where these very perfect adjuncts cannot be had, the plants will dry quite well in direct, strong sunlight, or by placing them on metal frames built up around the stove-pipe at home. The heat in either case must be strong enough to kill the larvæ rapidly as well as preserve the colors, or the specimens will be but poor at best.

Composition of Mushrooms.

There seems to be so much difference of opinion in regard to the value of mushrooms as foods, that a little time will be spent in quoting from those who have made studies upon these plants from the chemical side, as well as to mention the symptoms of and antidotes to mushroom poisoning given by chemists and physicians.

It seems from recent chemical analyses that too much credit has been given mushrooms as food plants. We can find in otherwise reliable scientific works the most extravagant statements about the nitrogen contents of these fungi, some giving it as high as 50 or 60 per cent of dry weight, and likening them to "beefsteak," "oysters," and other foods high in proteids. Perhaps the most

PLATE 6. The Gray-gilled Hypholoma, *Hypholoma capnoides*. Slightly reduced. A very fine mushroom, good raw or cooked, but closely resembling and growing with the Bitter Fasicled Hypholoma, *Hypholoma fascicularis*.

authoritative and careful analyses of these plants ever undertaken in our country were made by L. B. Mendel of the Sheffield Laboratory of Physiological Chemistry at Yale University, and published in the American Journal Phys. 1. 225-238. In this article Mr. Mendel draws comparisons between many kinds of foods such as beef, flour, beans, potatoes and cabbages, compared with several species of mushrooms He first goes on to show, that mushrooms, like most other vegetables, are composed largely of water, averaging between 70 and 92 per cent. He then shows that in the dry plants from 2 to 6 per cent of nitrogen is present, but that the mistake has been in thinking that on account of this high nitrogen content, all of it is of necessity *available nitrogen*. He shows the fallacy of this belief by proving that the proteid content, or the *food* nitrogen substance, is not higher than 3½ per cent. The fat extracts by ether he shows to be never higher than 6 per cent. Now comparing these with a few vegetables and meats, we can arrive at a better understanding of the food value of these fungi.

Nutritive Value of Ten Pounds of the Several Foods.

	PROTEIDS	FATS	CARBOHYDRATES	COST	CALORIES OR HEAT-GIVING UNITS FOR ONE CENT
Beef (round)	1.87	.88		$1 50	48
Beans	2.23	.18	5.91	.30	530
Flour (rolled process	1.13	.11	7 46	.25	658
Oysters	.61	.14	.33	2 00	11.7
Potatoes	.18	.01	1 53	.10	325
Cabbage	.18	.03	.49	.15	93
Coprinus comatus	.04	.025	.434	2.50	3 9
Pleurotus ostreatus	.051	.042	.828	2 50	7.2
Morchella esculenta	.094	.05	.306	2 50	3 8
Agaricus campester	.18	.03	.46	2.50	5.3

Assuming that these figures are correct, it is very evident that pound for pound, to say nothing of price, the mushrooms used do not compare with some of the commonest meats and vegetables in either of the following functions:

1. To form the material of the body and repair its wastes.

2. To supply energy for muscular exertion and for the maintenance of the body heat.

There is, however, according to Mr. Mendel and others, a very important office performed by mushrooms that cannot properly come under either of these two functions, and which cannot be measured by them, and that is *to act as relishes and helpers of digestion.* That this function of mushrooms is not to be slighted, is proved by the fact that these plants are welcomed on the tables of rich and poor alike, and that they have been proved by many years, nay centuries, of experience a very valuable adjunct to the bill of fare, when used alone or in connection with other foods to impart a relish. And this value, it may be remembered, is one which can be measured but poorly, if at all, by chemical analysis.

The second topic of this heading, the poisonous principles of certain mushrooms, will be touched upon, though in all cases of mushroom poisoning the best thing to do is to call in a good physician, where this is possible. The three worst principles or poisons obtained from mushrooms are Muscarine, Phallin and Helvellic Acid. Muscarine is the most dangerous alkaloid to be found in mushrooms. It is found in several of the Amanitas, and in a few Boleti and Russulas. A dangerous dose for a man is merely .003 to .005 of a gram, equivalent .06 of a grain. The worst feature about poisoning from these alkaloids is that they are not at once evident, but only after a lapse of several hours. Vomiting and diarrhœa generally occur, with flow of saliva, giddiness, and derangement of vision. This is succeeded by stupor, cold sweats, and weak heart action. If the stupor lasts for one or two days, death ensues. The treatment for this poison consists in carrying off all unabsorbed fragments of the mushroom from the alimentary canal, and in strengthening the weak heart action.

For the first the strongest emetics should be used, such as tartarized antimony and apomorphine; and to bring about the desired heart action, hypodermic injections of atropine, according to many writers, in doses of $\frac{1}{180}$ to $\frac{1}{50}$ of a grain, until about $\frac{1}{20}$ of a grain has been used. In very violent cases, and where the patient has been long ill before aid has been summoned even $\frac{1}{20}$ of a grain may be administered. "Freshly ignited charcoal or two grains of one per cent alkaline solution of permanganate of potash may be then administered, in order, in case the former or antimony emetic has been given to absorb the poison, or, in the case of the latter or apomorphine, to decompose it. This should be followed by oils and oleaginous purgatives, and the intestines should be cleaned and washed out with an enema of warm water and turpentine."

Phallin is a deadly poison, of uncertain chemical nature. Mr. Chestnut, of the Department of Agriculture, from whose Farmers' Bulletin on "Thirty Poisonous Plants" this description, as well as much under Muscarine, is taken, says, "A large number of cases of poisoning have been attributed to this fungus in ancient as well as in modern times. The symptoms are characteristic; no bad taste warns the victim, and usually the first effects do not appear until from nine to fourteen hours after eating. There is then considerable pain, and there may be cramps in the legs and other nervous phenomena, such as convulsions and even lockjaw. In a few cases there are spasms. The pulse is weak and either quick or slow in its action. The pupils of the eyes are sometimes dilated. The abdominal pain is rapidly followed by nausea, vomiting, and extreme diarrhœa, the discharges assuming the peculiar 'rice water' condition characteristic of cholera. The latter symp-

PLATE 7. The Chestnut colored Boletus, *Boletus clintonianus*. Slightly reduced. From the lowest specimen the stem has been cut away to show its solid nature, while from the intermediate one part of the cap has been cut away to show its solid nature and the depth of the "pores." Part of the slimy "veil" can be seen forming an irregular "ring" on the upper part of the stem of the last specimen. Of good flavor.

Fig. 7

Fig. 8

toms are persistently maintained, generally without loss of consciousness, until death ensues, as it does in from two to four days." "There is no known antidote by which the effects of Phallin can be counteracted" (the blood corpuscles being quickly dissolved, and the blood serum quickly escaping from the blood vessels into the alimentary canal). "The undigested material, if not already vomited, should, however, be removed from the stomach and intestines by methods similar to those given for cases of poisoning by Amanita muscaria."

Helvellic acid. This deadly poison has been extracted from a plant known as Helvella esculenta, Pers., or Gyromitra esculenta, Fr. There is no antidote known, and the action upon the blood corpuscles with the accompanying symptoms are similar to those of phallin poisoning. This poison has been found to be soluble in hot water, so if the plants are first soaked in hot water, and this thrown away, there is little danger in eating this fungus. As before remarked, fresh, young specimens seem to be free from this poison, as Mr. McIlvaine says he and his friends have eaten this plant with impunity.

It is a matter of interest that some of the fungi containing these poisons, and which are very poisonous in our country, are not dangerously so in others. The Amanita muscaria, containing the poison "Muscarine," is said to be used by the peoples of northern Russia to induce intoxication. It is likewise interesting that these poisonous plants may be cooked when they have been properly treated—a dangerous experiment at best. It is known that common salt is a solvent of phallin, and that vinegar is a remover of the poisonous muscarine. Mr. Coville, in the article before quoted, tells us of a colored woman in the city of Washington who prepared the deadly Amanita *for the table*, by scraping the plant clean, removing gills and peeling cap, then boiling in salt

PLATE 8. The Short-stemmed Boletus, *Boletus granulatus*. Slightly reduced. No ring is found on the short stem. The cap is a yellowish mud color. Equally good with the last.

and water, and, after steeping in vinegar, she washed them again, cooked them in gravy, and served with beefsteak! Though it is by no means certain that these poisons could be got rid of by salt and vinegar, if they have already been introduced into the alimentary canal, still it would be well worth remembering and giving them a trial, if one s ould have eaten of poisonous kinds, and should have found it out before the poisons had been absorbed into the blood, and were nevertheless so far removed from medical aid as to render summoning it impossible or unavailing.

The Growth of a Mushroom, With Names of Parts.

Very briefly now will be given the development of a mushroom, while at the same time the parts necessary to an understanding of what has gone before or what may follow will be explained.

Mushrooms, like many other plants, produce *spores*, not *seeds*. These spores sooner or later germinate, and give rise to a fine, generally white, stringy, underground portion called the *mycelium*. This mycelium has been observed by probably every one at some period of their lives, if they have ever pulled the bark from a rotten log, stirred up the deep humus in a forest, or opened up a pile of manure or an old straw-stack. The mycelium of the different mushrooms or toadstools is very generally dispersed, and though it may remain more or less dormant through the cold of winter or the dry, hot period of summer, especially if the soil has been deprived of its moisture naturally or artificially, yet as soon as the sun of spring shall have warmed the soil or the rains of fall shall have moistened it sufficiently, little enlargements are formed on the mycelium, which, sooner or later, and ordinarily with extreme rapidity, develop into the "buttons," or young mushrooms, and these proceed to force themselves through the soil and grow upward into the air. This aerial portion is merely a device for carrying the spore-bearing part of the fungus above the surface of the soil, and aiding in the dissemination of the spores by the winds. In many cases the spore-bearing body, called *sporophore*,

whatever its form, is pushed up only to the surface of the earth, as in the Puff-balls; at others it is entirely subterranean, when the sporophore must decay before the spores can be liberated, as in the Truffle.

At times the young sporophore is completely covered by a soft covering, which ruptures as the plant pushes upwards, sometimes to leave a cup at the base of the stem and fragments upon the cap, as in the Amanitas; at others to leave a mere remnant in the shape of hairs on cap and stem, as in Cotinarius. In most of the mushrooms this outer covering is completely lacking. As the sporophore grows, it commonly becomes differentiated into a *stem*, and a *cap* surmounting the stem. Under this cap (see chart), in the Agaricaceæ, the Polyporaceæ, and in most of the Hydnaceæ, peculiar organs are developed to support the spore-bearing surface or *hymenium*. In the Agaricaceæ the hymenium is spread over flat plates, which radiate from the center, and are called *gills*. In the Polyporacæ, *tubes*, cylindrical or quite angled, take the place of *gills*. In the Hydnaceæ the spore-bearing surfaces are extended into long or short *spines*. For the characters of those other families of the Hymenomycetes, see the chart. The remainder of the cap, supporting the *hymenium*, is known as the *hymenophore*, a name signifying "hymenium supporter." Projecting from the gills, or other kinds of spore-bearing surfaces, are found, under the microscope, peculiar bodies like Indian clubs, called *basidia*. These basidia bear on their extremities *spores*, varying in number in the different families, but ordinarily four, and raised above the *basidia* on little sharp points, known as the *sterigmata* (singular "sterigma"). In many of the Agaricaceæ and Polyporaceæ the hymenial surface is protected in its early growth through the earth, and in some cases to near full maturity, by a kind of curtain, which joins the edge of the cap to the stem, and is known as the *veil*. As the plant reaches maturity, this veil is ruptured by the lateral growth of the cap, and a part of it may hang from the edge of the cap, or, as is most usually the case, the greater part of it may be left adhering to the stem as

a *ring*. The Common Field Agaric, on Plate II, shows the formation and rupturing of this veil to perfection.

In all of the families of the Hymenomycetes (see chart), the *hymenium* or spore surface is *exposed*, and the spores when mature are borne away by the wind. In the Gasteromycetes, another family or division of the Basidiomycetes, the spore-bearing surface is *enclosed* within a covering, called the *peridium*. If we translate the word Gasteromycetes literally, it means "*Belly-fungi*"—an appropriate name, as the spores are all hidden within the belly-like pouch. This *peridium* sometimes opens regularly at top, sometimes very irregularly, and sometimes not at all, unless the irregular scaling-off of the hard covering could be called opening. The Puff-ball is a good example of this family. As this plant comes to maturity it opens on top, the contents are divided up into a loose mass of spores and filaments, and the slightest pressure from the outside will cause to be ejected a yellow or purple cloud of the contents.

In the great class of *Ascomycetes*, a division of the Sporidifera, the spores are not free and placed upon the tips of *sterigmata*, but they are produced in little cases, called *asci* (singular "ascus"), and these asci, together with sterile accompanying bodies called *paraphyses* make up the *hymenium*. In both of these great classes of fungi, the spores are produced *asexually*—that is, without distinctly male and female organs.

Chart Illustrative of Different Families of Mushrooms.

- **1. SPORIFERA**—Spores free and naked or soon becoming exposed.
  - **1. BASIDOMYCETES**—Spores borne on basidia, bodies shaped like Indian clubs, and accomdanied by sterile cells, cystidia and paraphyses, all forming the *hymenium*.
    - **1. HYMENOMYCETES**—Hymenium free and naked or soon exposed.
      - 1. AGARICACEÆ—Hymenium in plates on under side of cap.
        - 1. White spored. Ex. *Hygrophorus.*
        - 2. Yellow spored. Ex. *Cortinarius.*
        - 3. Rosy spored. Ex. *Pluteus.*
        - 4. Purple-brown spored. Ex. *Agaricus.*
        - 5. Black spored. Ex. *Coprinus.*
      - 2. POLYPORACEÆ—Hymenium below, tubular or porous. Ex. *Boletus.*
      - 3. HYDNACEÆ—Hymenium below, warted or with spinose processes. Ex. *Hedge-hog* or *Bear's Head Fungus.*
      - 4. THELEPHORACEÆ—Hymenium on under or outer surfaces, but nearly plane. Ex. *Goblet Mushroom* or *Craterellus.*
      - 5. CLAVARIACEÆ—Hymenium covering all sides of upright stems. Ex. *Coral Mushroom* or *Clavaria.*
      - 6. TREMELLINEÆ—Hymenium covering free surface, or only one side. Whole fungus more or less gelatinous. Ex. *Tremella, Hirneola.*
    - **2. GASTEROMYCETES**—Hymenium enclosed in an outer case, called the peridium, through which the spores escape by either regular or irregular rupture. Examples. *Puff balls, Stink horns.*
  - **2. NON-BASIDIA BEARING.**
    - *3. Coniomycetes.*
    - *4. Hyphomycetes.*

    None mushrooms.
- **2. SPORIDIFERA**—Spores enclosed in minute, nearly transparent sacs, called "asci."
  - **1. PHYCOMYCETES**—Microscopic fungi, none mushrooms.
  - **2. ASCOMYCETES**—Proper ascus bearers.
    - 1. DISCOMYCETES. DISC fungi; spores from 2-8, produced in sacks which are immersed in the flesh of the outer and upper surface of the cap. Ex. *Morel, Helvella.*
    - 2. TUBERACEÆ. Subterranean, large, globose, not rupturing. Ex. *Truffle*

Having thus far discussed mushrooms or toadstools generally, I shall now describe a few of our most common and edible species, illustrated by cuts, shall tell where to find them, and how to prepare them for the table, and shall leave to later bulletins the discussion and discription of many other edible or injurious species. The species described in this paper are the most easily found, the most abundant, and the kinds most commonly collected for the table in America as well as in parts of Europe. It is not the intention to make these descriptions long or scientific, but merely to supplement the plates by a few sentences, telling how these several kinds may be known and where they may be found.

The Common Field Agaric or Pink Gills.

(*Agaricus campester*). Plates I and II.

This is the plant to which the name "Mushroom" is commonly applied in its most limited application. It is common under many forms both in Europe and America and is the one almost invariably bought in stores under this name. In the first stage at which it is gathered for food, the "button" stage, it is a little, white object closely resembling a puff ball, about one inch or less high and nearly as wide. If we dig it up, we shall find it differs from the puff-ball in having a distinct stem. Split one of these buttons down, and then we clearly make out, (1) a *stem or stipe*, (2) a *cap* or *pileus*, (3) the *gills* or *lamellae*, and (4) the *veil* or *velum*, a white soft membrane extending from the edge of the cap to the stem. (See Plate II). As the "button" grows into the mature mushroom, the veil is ruptured, and we see fragments of it adhering to the edge of the pileus, while the greater part, becoming entirely separated from the cap, remains somewhat down the stem as a ring or *annulus*, though the ring may occasionally be

PLATE 9. The Bear's Head or Hedge-Hog Mushroom, *Hydnum Caput-Ursi*. One-third natural size. Grows on old logs in woods, yellowish white to pure white in color. Delicious stewed.

Fig. 9

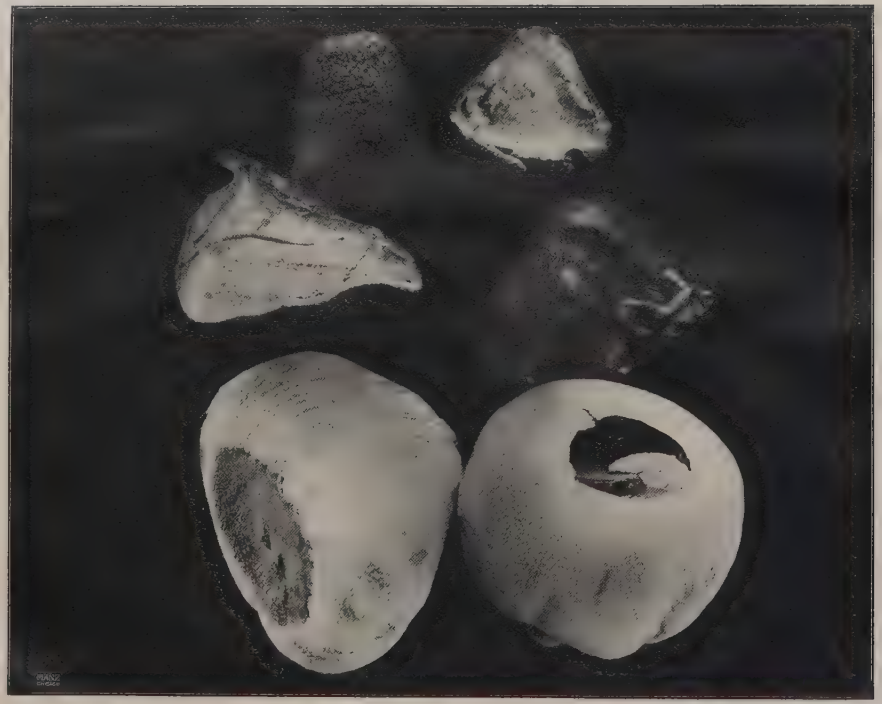

Fig. 10

almost entirely lacking. The cap is from 2 to 5 inches wide, and white, though it varies from smoky-gray to gray-brown, especially as it grows old. The gills when young are *pink* or *flesh-color*, and this has proved one of the best marks by which to separate this species from some of the deadly Amanitas, which have *white* gills. Our plant, moreover, has no *volva* or *cup*, the most common badge of the Amanitas. As the plant matures the spores are formed in great abundance on the gills, and as these spores vary in color from brown to brownish-purple, they soon give the gills a dark color, approaching black. The gills are also *free* from the stem,—that is they are not joined onto the stem, but merely onto the cap, and are of various lengths, some short, some intermediate, some long. The stem is white, generally solid, brittle, and of about the same consistency as the cap, and therefore good as food. It varies in height from 1 to 3 inches and in diameter from ⅓ to ¾ of an inch. It is found growing spontaneously in our moist pastures, especially when enriched by the droppings of cattle. The "buttons", as previously remarked, are produced upon the white, stringy, underground *mycelium*, and gradually enlarging push their way into the air to scatter their *spores*. The vitality of this mycelium or "spawn" is remarkable. It withstands the hottest, driest soils to come out with the first rains of fall as strong and productive as ever. Relying upon this capacity in the mycelium to withstand drought, mushroom growers prepare this spawn for the market, and it is then capable of being sent round the world in its dried condition without injury. What follows is taken mainly from Farmers' Bulletin No. 53, United States Department of Agriculture, entitled "How to Grow Mushrooms", by William Falconer. Two kinds of spawn are in general use amongst our mushroom grow-

PLATE 10. Puff balls. The two largest have matured and one shows the mode of opening to disgorge the spores. The next one, split in two, is somewhat too old for food, the spore mass turning yellow. The smallest one, but a different species, is just in the state for food, being white and solid within. Somewhat reduced.

ers, one prepared by the English in shapes like "bricks", the other by the French in loose pieces called "flakes". The English "brick" is put up with the mycelium in dry dust manure and compressed, and the more spawn to the brick the better it is. These bricks are then broken up into about a dozen pieces, and these pieces planted. The French "flake" consists of dry mycelium mixed in with dry unrotted horse manure, generally in 3 pound boxes. The flakes are broken up and planted like the pieces of brick. This is generally in cellars, barns, sheds, greenhouses or other buildings where moisture and temperature can be maintained equable. In these places beds can be made, about 14 inches deep, out of common lumber, and filled with the "host" or material upon which the mycelium is to feed. The best material for this purpose is horse manure, or ⅓ cow manure and ⅔ horse, mixed with from ¼ to ½ rotted sod loam, and allowed to get through heating by wetting and turning. First fill in the beds with a 6-inch layer of well-moistened, even hot manure, and tramp it down firm. When this has cooled somewhat, put on layer after layer of the prepared manure, raising the under manure with the fork. When the bed is made, throw over it some loose hay or straw to arrest the steam, leaving it on till you wish to plant. Spawn the bed when the heat has fallen below 100° F., about 90° being considered best. Plant in rows, 1 foot apart and 9 inches between pieces. Raise the manure with the hand, insert the piece 2 or 3 inches below the surface, and then press down manure. When the entire bed is spawned, pack the whole tightly, and recover the surface with hay, straw, or mats to keep the surface moist. At the end of 8 or 9 days remove the mulching and cover the beds with good loam 2 inches thick, leaving the surface fine and mellow. The temperature should be about 55° F.,—not lower than 50° nor higher than 65°. Water the beds from time to time, keeping them covered with a mulching till the "buttons" begin to rise. Mr. Falconer says, "Mushrooms are easy to grow and beginners are often as successful with them as are those having an extensive experience. Success depends upon general con-

ditions, good materials, interest in the business, intelligent management, and persistent application."

The Shaggy-Mane Mushroom.

(*Coprinus comatus*) Plate III.

This handsome and peculiar mushroom must have fallen under the observation of many persons, growing as it does, in our state, along the railroad tracks, cuts and embankments, wherever there is sufficient moisture supplied, from September to November. In and near the city of Moscow hundreds of pounds of this fine mushroom go to waste with scarcely a person to gather it. As I have never seen this species growing in any other localities save those mentioned, it seems as if the Shaggy-Mane must have been introduced through the rolling stock of rail roads and their contents. This may be found to be an error later, and that the plant is indigenous in many localities. It certainly is a conspicuous object when it reaches full proportions on some moist, soft clay bank, with its long white cap looking like a much torn and closed umbrella. The plant when cooked is somewhat stronger than the Field Agaric, but for this very reason is preferred by some persons. The whole plant is whitish or with a little brown discoloration at the top of the cap. The cap is almost cylindrical, rounded at top, and shaggy with scales which are often, especially in their early condition, brown at tip. The gills are long, light colored, and altogether free from the hollow stem, being attached to the underside of the cap. In the "button" stage the cap is connected to the stem by a "veil", which is later ruptured by the elongation of the cap and stem, but differs from the Field Agaric in this: While in that species the "ring" remains attached either wholly or in fragments to the stem, in the Shaggy-Mane the ring is freed from both the cap and stem, and forms a true ring, dropping to the ground as the smooth white stem lengthens. Very soon a change or disintegration begins to show

itself in the cap. The gills change to a bluish color, then to a blackish, and then begin to melt or "deliquesce", changing into a fluid black as ink, composed of water and the now ripe and black spores. While this change is going on in the gills, the edge of the thin cap becomes lacerated, bends up and out, and when the deliquescence is completed is found on the top of the as yet smooth and unimpaired stem,--a flattened mass with backward rolled edge, and dripping with the black fluid. As soon as the gills commence to discolor, the plant is unfit for food, while it is at its best before the ring has become separated from cap and stem, or while it is still in the button stage. Wash the caps before cooking to get off any dirt, but especially to remove the fluffy scales.

The Ink-Cap.

(*Coprinus atramentarius*) Plate IV.

This plant somewhat resembles the Shaggy-Mane, but in our State it is nearly always devoid of scales. It is always egg-shaped or oval, not cylindric like the last, and of a darker color, varying from ashen gray to smoky brown, almost always "striate" or furrowed, with a shorter stem and no separating ring, but in its place an irregular and prominent line surrounding the stem near its base. It is not nearly so common as is the Shaggy-Mane. It is sometimes found growing singly, but more commonly in clusters from 3 to 12. The stem is smooth above the ring, and somewhat scaly below it. In the specimens shown in the plate, the ring has been entirely washed off in freeing the plants from the heavy clay in which they grew. The plant melts away to scatter its spores just as does the Shaggy-Mane, and receives its name of "Ink Cap" from the striking resemblance the cap bears at this period to an open ink-well. Mr. McIlvaine tells us that he has used the fluid as an ink with which to draw a picture of the fungus.

PLATE II. The Morel *Morchella bispora*. Slightly reduced in size.

Fig. 11

Fig. 12

The Ivory Hygrophorus.

(*Hygrophorus eburneus*) Plate V.

This very pretty mushroom is found in immense quautities in our moist pine woods on north slopes. Owing to the very slimy coat of gluten which covers cap and stem, causing it often to slip from your hands like an eel, it is not an agreeable plant to handle; but when cleaned nicely and cooked into a stew, we lose all thought of its disagreeable exterior in admiration of its delicate oyster flavor To the writer this flavor excels that of any of the former mushrooms, and makes it one of the most savory ever tasted. It has a decidedly vegetable rather than meat flavor, with a delicate reminder of oyster or clam. Its ivory-like color and lustre, together with its slimy coat, well serve to distinguish it from any of the other white mushrooms, many of which are found in our forests and at a distance can hardly be distinguished from the Ivory Hygrophorus. It is widely distributed in Europe and America, and tons upon tons could be collected on any of our wooded hills from September to far into December, if the temperature will allow, as it did this year. The plants vary much in size, from 1 to 4 inches wide, and from 2½ to 6 inches high. The gills are white like the rest of the plant, and are conspicuously "decurrent", that is they run down the stem from the cap for quite a distance. The stem is generally bent over to one side, and oftenest tapers downwards. The pileus or cap is moderately thick, generally flat or convex, though at times as the plant grows older it becomes tilted upwards, and is always incurved along the edge when young. The spores are white. Many other species of this interesting genus are to be found abundantly in our fir woods, or in forests of mingled pine and fir, but the discus-

PLATE 12. Fly Amanita, *Amanita muscaria.* Poisonous One-half natural size. F V. Coville, Circular No. 13, Department of Agriculture, Division of Botany, "Observations on Recent Cases of Mushroom Poisoning in the District of Columbia".

sion of these will be reserved for future bulletins. As far as the writer has observed they are all edible, and though of various shades from white, yellowish-white, yellow, yellowish-red, to dull brownish or dirty olive, they all agree in these important generic characters: the gills are rather distant, of a waxy consistency broadening towards their attachment to the cap, and the central portion of the gill, called the *trama*, is but a continuation of the material of the pileus, so that when they are pulled off from the cap, they each leave a projecting line of the trama behind them on the cap.

The Gray-Gilled Hypholoma.

(*Hypholoma capnoides*). Plate VI.

This toadstool is one of the most choice we have, and is agreeable either raw or cooked. It is commonly found about old stumps, though it is by no means uncommon where dead wood has decayed, or where rotten roots come near the surface of the ground. It so closely resembles another Hypholoma of this section, that the taste is the best means of distinguishing them. Chew a little piece. If the plant selected is of our species, it has a sweet nutty taste; if it belongs to the closely related *H. fasciculare*, growing in just such spots, it is as bitter as gall. To the observant eye there are other differences which distinguish these two species. The Bitter Hypholoma has a yellowish cap and a yellowish-green cast to the gills; the gray-gilled Hypholoma has a cap of yellowish-red to dark red at the center, and the gills are of a decided *purplish slate* color.

This genus of plants furnishes many edible species all over the world, and many are to be found in our own country. The main marks of distinction by which this toadstool may be known are these. The plants generally grow in clusters and often together ("connate") on flexuous stems 3 to 6 inches long and ¼ to ½ inch thick. The caps are yellowish-red, darker in the center and

from ½ inch to 2 inches wide, fleshy, convex to flat, smooth. Flesh white or with a slight shade of lemon. The gills are attached to stem (*adnate*), but separate easily, are broad and close together, and of a purplish-slate color when mature and covered by the spores, though light colored before the spores darken them.

The Chestnut-Colored Boletus.

(*Boletus Clintonianus*). Plate VII.

On referring to the plate, it will be seen that this plant is radically different, when viewed from below, from any of the mushrooms so far described. While all of the previous kinds had gills radiating from the center to the circumference, these have *pores* scattered irregularly over the lower surface of the cap, or in one genus radially arranged though definite pores. Still this distinction is more apparent than real, for some of the Agaricaceæ have gills approaching pores, while some of the Polyporaceæ, to which belongs the Boletus, have the pores radially arranged and longer than wide, thus approaching the first family. Both have "basidia", with the "spores" placed on "sterigmata", and accompanied by sterile bodies called "cistidia".

The Boleti give us probably more edible and at the same time larger mushrooms than any other genus. Prof. Peck, who has made an exhaustive study of this genus, enumerates about 120 species in America, the greater part of which are edible, though some are intensely bitter, and a few are poisonous. Though the poisonous species are mainly limited to species *possessing red mouths to the tubes*, there are some intensely bitter and even suspicious kinds outside of this section of *Luridi*, as it is called; so it best to test each individual carefully by the rules laid down previously. This has been my method of procedure with this species and with others, and I have found that when I collected the caps of this Boletus, cleaned them carefully and removed the tubes (which cook slimy), it is very fine fried or broiled. This is

a very common and conspicuous toadstool in our pine woods, and a basket-full can be collected in a short time throughout September and October, while it is not a rare plant in other months.

The plants vary from 2 to 3 inches in height, the caps from 1.5 to 3 inches broad, and the stem from ¼ to ½ inch thick. The cap is generally a fine red-brown though it may be yellowish, and when fresh is very slimy. The flesh is yellowish and thick. The stem has a more or less noticeable *ring*, which at first covers the tubes as a glutinous *veil*. The spores are oblong-spindle shaped, and of a yellowish ironrust cast.

The Short-Stemmed Boletus.

(*Boletus granulatus*). Plate VIII.

This plant is much like the last in size, but it can easily be told from it. The cap varies in color from a light dirty yellow to gray-mud; the stem is short and without ring or veil. More exactly the plant may be thus described: The pileus is convex to nearly plane, ordinarily somewhat undulate or irregular, very viscid when moist, varying from yellowish to grayish-brown; flesh pale yellow; tubes short, growing close up about the stem, yellowish, the mouths *granulated*; stem dotted with glandules above.

This mushroom is in excellence equal to the former and is found growing with it, though it seems to prefer the deeper woods. I have found it, however, growing on bare spots on hill-tops, unprotected by but not far from trees.

Other Boleti are found in our woods, but as they have not been tested by the writer, they will be left for future bulletins.

The Hedge-Hog or Bear's-Head Mushroom.

(*Hydnum Caput-Ursi*). Plate IX.

This very conspicuous mushroom is found quite commonly in fir forests, growing up from or hanging down from some old log.

Its whiteness and beauty (see plate) make it a very conspicuous object, and one who has once seen a large specimen of this plant is not likely to forget it or to mistake it, except for closely related species. It belongs to another family of the Hymenomycetes or Free-spored Mushrooms, viz., the *Hydnaceae*. These fungi are noted for having the hymenium arranged on *spines* or *tubercles*, which are ordinarily situated on the under side of the cap, but when they grow, as does this plant, either on the upper or under side of a log, the spines may be considered as growing either on the upper or under side of the cap. There are several closely relately species of Hydnum belonging to this section of the plants, but as they are all edible, and as this is the only one found in our neighborhood, one will answer for all. The plants vary from 6 to 8 inches high, and as much or more across. The tufts are pendulous or upright, compact, white or with a yellowish tinge when old or dry. The spines are from ¼ to ¾ of an inch long, round, and pointed. The branches come off in every direction and are short.

This plant when washed and minced, and then cooked like oyster-stew, makes an excellent dish.

Puff Balls.

Lycoperdon, of different species. Plate X.

Very few would suspect that these common plants, filled when ripe with a powdery dust consisting of mingled spores and tissue, and looking at this time any thing but appetizing, are *when young* solid, white within, nearly all edible, and some delicious. In the plate are shown four plants of two different species. Two are mature, have opened by an irregular chink at the top, and are ready to eject the spores. Two are cut open and are exposed each with one cut side down, the other up. In the larger, the spores have begun to form though it is still of solid consistency, and the spore-bearing portion is taking on a yellow color. The plant is too old to be at its best, though it is not hurtful even at

this stage. The other is solid all through, white, and is just at its prime for eating. It has been found by many who have eaten puff-balls, that the *larger* species are much better than the smaller ones. One, known as The Giant Puff-ball, *Lycoperdon giganteum*, or *Calvatia gigantea* according to some, is so rare in Idaho that it has not been represented by chart, though there is a specimen in the University Herbarium, and found near Moscow, which is 14 inches long, 11 inches wide, and 5 inches thick. The "Country Gentleman" some years ago mentioned a giant puff-ball which weighed 47 pounds and measured a little over 8 feet in circumference. Vittadini says of them "when the giant puff-ball is conveniently situated, you should only take one slice at a time" (more if you need it) "cutting it horizontally and using great care not to disturb its growth, to prevent decay, and thus one may have a fritter every day in the week." They are certainly delicious when sliced and fried in butter like egg plant.

The two species represented in the Plate are our most common ones, *Lycoperdon caelatum* (Calvatia caelata of some), and *Lycoperdon gemmatum*. I have only tried these raw, and find them both good; but those who have cooked them both say that the first, the larger, is much the better. The small species are said to be rather strong. However, no puff-ball is poisonous, or even injurious, so one can hardly make a mistake if several species are gathered, save that some are better than others. *L. caelatum* is known by its top-shaped *peridium* or coat, white to light cream in color, 3-5 inches in diameter, granulate rough or almost smooth, and flat above or somewhat depressed, and breaking away by a large irregular hole at top. The spores and fibres are yellowish green or olivaceous. *L. gemmatum* is smaller, generally more tapering at base, and the top and sides of the peridium are rougher with conical, white projections.

The Morells.

Morchella bispora, and others

These peculiar plants differ from any of those described in hav-

ing the spores enclosed in *sacs*, and these immersed in the substance of the cap so that their upper ends are about even with the upper surface. They do not therefore belong to the *Sporifera*, with spores, free or inclosed, on the ends of basidia; but to the *Sporidifera*, with spores in sacs, and to the family Discomycetes, or Disc Fungi. There are many species belonging to the genus Morchella, this one being a rare species, with but two spores to the ascus or sac, and hence it is called *Morchella bispora*. All that have been tried have been found to be esculent, but on account of the rarity of this species, I doubt whether it has often been tested. Dr. Taylor in his "Mushrooms of America", says it is edible. Care should be exercised that these fungi, if to be eaten, are always in their prime; not infested with larvæ, nor too old, since from a closely related genus *Gyromitra esculenta*, the deadly "helvellic acid" has been separated. As before stated even this species, when at its prime, has been eaten by many parties without experiencing the slightest inconvenience. Even should this acid be found in species of this genus, it would probably only be found in specimens in too advanced a condition. The species quite common in the west as in the east, *Morchella conica* and *M. esculenta*, are equally celebrated in the "cuisines" of Europe and America as "*the* morells".

The genus Morchella is easily known (See Plate XI.) by t e dark corrugated cap and the light stem. These corrugations run up and down the cap like the convolutions of the brain, and do not consist of rounded knobs, like a thick cluster of grapes, as in Gyromitra. In this species, M. bispora, the cap is rather wide, and free from the stem up to the top; the stem is white and rather long; the asci or sacs contain but two large spores.

It is the intentiou of the writer to continue these bulletins on edible and poisonous mushrooms until most of our largest and best-defined species have been described. This cannot be done until more careful trials have been given them to find out whether they are edible or not. Sufficient species have, however, been described in this number to allow a selection to every one for many months of the year.

RECIPES.

The following recipes I have taken wholesale from the books of McIlvaine, Atkinson, and others, thinking that I do violence to no one's prerogatives in letting people know the best recipes of some of the best cooks in America.

To Prepare and Cook Agaricus.

They can be collected up to the time the gills begin to soften. Cut off the extreme butt of the stem. Rub off the cap and stem with a towel or flannel. Do not peal. Wash in cold water. Drain well, gills downward.

BROIL.

Use well spread caps only. Use double iron broiler. Place the caps on it, gills down, and broil two minutes, turn and broil two minutes more. While hot, season with salt and pepper, and butter well, especially upon the gill side. Serve upon toast.

FRY.

Lay them in a frying pan in which butter has been heated boiling hot. After frying five minutes, serve on a hot dish,—pouring over them the sauce made by thickening the butter with a little flour. This is as delicious as more elaborate ways of cooking and retains the mushroom's distinctive flavor in full perfection.

STEWED ON TOAST.

Cut the mushrooms,—caps and stems—into pieces of equal size. Place in a covered saucepan. To each pint add one ounce (two level tablespoonfuls) of butter. Enough water will have been retained by gills after washing to make sufficient liquor. Stew slowly twenty minutes; season to taste with pepper and salt. place upon toast.

STEWED.

To each pound allow two ounces of butter. Put the butter into a saucepan, and when melted, not brown, throw in the mushrooms either whole or cut into slices; sprinkle over a teaspoonful of salt; cover the saucepan closely to keep in the flavor, and cook very slowly for twenty minutes or until they are tender. Moisten a rounding tablespoonful of flour in a little cold milk; when perfectly smooth, add sufficient milk to make one gill; stir this into the mushroom, add a salt-spoon of white pepper, stir carefully until boiling, and serve at once. This makes a fairly thick sauce. Less flour is required when they are to be served as a sauce over chicken, steak or made dishes.

PUREE.

Wash carefully a half pound of mushrooms; chop them fine, put them into a sauce pan with a taplespoonful of butter, and if you have it, a cup of chicken stock; if not, a cup of water. Cover the vessel and cook slowly for thirty minutes. In a double boiler put one pint of milk. Rub together one tablespoonful of butter and two tablespoonfuls of flour; add to it the milk; stir and cook until thick; add the mushrooms, and press the whole through a sieve; season to taste with salt and pepper only.

CREAM OF MUSHROOM SOUP.

This will be precisely the same as the preceeding recipe, save that one quart of milk will be used instead of a pint with the same amount of thickening, and the mushrooms will not be pressed through a sieve.

To Prepare and Cook Croprinus.

BAKE.

Being soft and juicy, they must be handled with care, and are much better cooked with dry heat. Remove the stems and wash them carefully; throw them into a colander until dry; arrange them in a baking pan; dot here and there with bits of butter, al-

lowing a tablespoonful for each half pound of mushrooms; dust with salt and pepper, run them into a very hot oven, and bake for thirty minutes; dish in a heated vegetable dish, pouring over them the sauce from the pan.

STEWED.

Wash and dry them; put them into a large, flat pan, allowing a tablespoonful of butter to each half pound of mushrooms; sprinkle at once with salt and pepper; cover the pan and stew for fifteen minutes. Moisten a tablespoonful of flour in a little cold milk; when smooth add a half cup of cream, if you have it; if not a half cup of milk. Push the mushrooms to one side, turn in the mixture and stir until boiling. Do not stir the mushrooms, or they will fall apart and become unsightly. Dish them; pour over the sauce and serve them at once. Or they may be served on toast, the dish garnished with triangular pieces of toast.

How to Prepare and Cook Boleti.

BAKED.

Wash the caps and remove the pores; put the mushrooms into a baking pan; baste them with melted butter, dust with salt and pepper, and bake in a moderately quick oven three-quarters of an hour; dish in a vegetable dish. Put into the pan in which they were baked a tablespoonful of butter. Mix carefully with a tablespoonful of flour and add a half pint of stock, a half teaspoonful of kitchen bouquet or browning, the same of salt, and a dash of pepper; pour this over the mushrooms, and serve.

FRIED.

Wash the caps and remove the pores. Dip the caps in beaten egg, then in bread crumbs, and fry them in smoking hot fat; oil is preferable to butter, even suet would make a drier fry than butter or lard. Serve at once as you would egg plant.

BROIL.

Remove stems and cap, unless young, or the dish will be slimy.

Wipe the caps clean. Put on a wire broiler or in a hot buttered pan. Cook well. Add butter, pepper and salt.

To Prepare and Cook Hydnums.

Use the tender parts only of stems and caps of the capped species, and soft, fresh parts of the maned species; cut into small pieces of similar size, stew slowly in covered sauce pan for from thirty to forty minutes, season with butter, pepper and salt. Serve.

To Prepare and Cook Puff-Balls.

FRY.

Remove the outer rind, slice, dip in egg and bread crumbs, and fry as egg-plant; serve.

STEW.

Cut in dice-shaped pieces, stew for 15 minutes in a little water, pour off the water, dust with a little flour, add a small quantity of cream or milk, butter, pepper and salt, and a little parsley. Stew slowly for five minutes. Serve. The puff balls should be perfectly white inside; any stains or yellow part should be removed, otherwise they will be bitter.

To Prepare and Cook Hypholomas.

STEW.

Wash the caps, stew slowly in the water which the gills retain for half an hour, keeping dish covered. Add plenty of butter, pepper and salt to taste, add cream or milk with a little thickening.

Most of the Hypholomas have a slightly bitter taste, of which most persons become very fond; if it is objectionable, add a small amount of lemon juice or sherry.

A Hunter's Toast.

Carry a vial of olive oil or a small can of butter, some pepper and salt mixed. An edible toadstool found, collect a few dry twigs, fire them. Split a green stick at one end; put the toadstool in the cleft, hold it over the fire; oil or butter, season. Eat from the stick.

Dozens of more intricate ways of cooking mushrooms can be fonnd in McIlvaine's "One Thousand American Fungi" and in Atkinson's "Mushrooms Edible, Poisonous etc.", but we have endeavored to select the shortest and simplest recipes from both works.